Coimisiún na Scrúduithe Stáit
State Examinations Commission

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Ceimic   *Gnáthleibhéal*

Marking Scheme   *Leaving Certificate Examination, 2004*

Chemistry   *Ordinary level*

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Leaving Certificate Examination 2004

Chemistry - Ordinary Level

Marking Scheme

Introduction

In considering the marking scheme the following should be noted.

1. In many cases only key phrases are given which contain the information and ideas that must appear in the candidate's answer in order to merit the assigned marks.

2. The descriptions, methods and definitions in the scheme are not exhaustive and alternative valid answers are acceptable.

3. The detail required in any answer is determined by the context and the manner in which the question is asked, and by the number of marks assigned to the answer in the examination paper, and in any instance, therefore, may vary from year to year.

4. The bold text indicates the essential points required in the candidate's answer.
    Words, expressions or statements separated by a solidus (/) are alternatives which are equally acceptable. A word or phrase in bold, given in brackets, is an acceptable alternative to the preceding word or phrase. Whilst only key words and phrases are indicated in the marking scheme they must be presented in answers in a correct context if full marks are to be awarded.

5. In general names and formulas of elements and compounds are equally acceptable except in cases where either the name or the formula is specifically asked for in the question. However, in some cases where the name is asked for, the formula may be accepted as an alternative.

6. There is a deduction of one mark for each arithmetical slip made by a candidate in a calculation.

Outline Marking Scheme

Eight questions to be answered in all. These *must* include at **least two** questions from **Section A**.

Section A

Question 1
(a), $(2 \times 4, 3)$; (b), (6); (c), (6); (d), (6, 3); (e), (6×3)
Question 2
(a), $(2 \times 4, 3)$; (b), (2×3); (c), (6, 3); (d), (6); (e), (3×3); (f), (9)
Question 3
(a), (5); (b), (2×6); (c), (3); (d), (6); (e), (6); (f), (3, 6, 3); (g), (6)

Section B

Question 4
Eight highest scoring items to count.
One additional mark to be added to the first two items for which the highest marks are obtained.
(a), (6); (b), (6); (c), (6); (d), (2×3); (e), (6); (f), (6); (g), 6); (h), (6); (i), (6); (j), (6); (k), (2×3)

Question 5
(a), (6×6); (b), (9); (c), (5)

Question 6
(a), (i), (5); (ii), (6); (iii), (6); (iv), (6); (v), (6); (b) (2×6); (c), (3, 6)

Question 7
(a), $(2 \times 4, 3)$; (b), $(2 \times 3, 2 \times 6)$; (c), (2×3); (d), (9); (e), (6)

Question 8
(a), (5); (b), (6); (c), (3×6); (d), (6×3); (e), (6, 3)

Question 9
(a), (5, 6, 6, 3); (b), (5×6)

Question 10
(a), (4, 4, 5, 6, 6)
(b), (4, 3, 6, 9, 3)
(c), (4, 3, 3, 3, 6, 6)

Question 11
(a), (7, 6, 6, 6)
(b), (7, 3, 3, 3, 9)
(c), **A**, (5, 5, 6, 3, 3, 3)
    B, (5, 6, 6, 3, 5)

Question 1

(a)   X   = **Ethanol (ethyl alcohol)/ C_2H_5OH**   (4)

        Y   = **Aluminium oxide / Al_2O_3 / alumina**   (4)

        Colour = **White (whitish)**   (3)

(b)   Purpose = **Hold the ethanol / soak the ethanol / avoid wetting the aluminium oxide**   (6)

(c)   Not used = **Contain** displaced **air**   (6)

                             [Accept "impure" for 3 marks]

(d)   Suck-back = **Cooling of gases in system / contraction of gases in tube /**

                            decrease in pressure inside system

                            [Accept "due to cooling" for 3 marks]

        Prevention = **Remove delivery tube from trough** when heating stopped **/ dismantle the apparatus**   (6 + 3)

(e)   Combustion = **Ignite** gas jar (test tube) using taper (lighting splint)   (3)

        Observation = **Luminous** / slightly **smoky (sooty)** flame / **yellow**   (3)

        Products   = **Carbon dioxide / CO_2**   (3)

                            Water / H_2O   (3)

        Test **CO_2** = Turns **limewater**   (3)

                            Milky   (3)

              or

        Test **H_2O** = Turns **Cobalt chloride paper // anhydrous copper(II) sulfate**   (3)

                            Pink // blue   (3)

                            [Answers must be matched]

Question 2

(a) A   = **Pipette**

B   = **Burette**

C   = **Conical flask / titration flask**   (2 × 4 + 3)

(b) Rinsing   = wash with deionised **water** /distilled **water**   (3)

wash with **sodium carbonate / solution it is to contain**   (3)

(c) Precautions = **Clamp vertically / read bottom of meniscus / read at eye level / make sure area below tap is full / use white card / remove funnel from top of burette**

(6 + 3)

[Accept "wash with deionised **water** /distilled **water**

wash with **hydrochloric acid / solution it is to contain**" for (6 + 3)]

(d) Use   = **Wash down the sides of the titration flask / wash in drops** of reactant   (6)

(e) Indicator = **Methyl orange / methyl red**   (3)

Colours   = **Yellow / orange** to   (3)

Pink / Red [Accept **peach**]   (3)

[If colours reversed allow 3 marks]

(f) Conc.   = **0.25** M   (9)

[Accept 6 marks for 0.2 or 0.3 if no calculation is shown]

$$\frac{25 \times 0.10}{1} \ (3) \ = \ \frac{20 \times M}{2} \ (3)$$

Concentration = **0.25 M** (3)

[Allow 3 marks for correct formula]

Question 3

(a)   Exothermic = **Heat (energy) given out** in the process   (5)

(b)   Material   = **Polystyrene / plastic**   (6)
       Explain   = **Insulator / prevent (reduce) heat loss**   (6)

(c)   Equipment = **Graduated cylinder / pipette / burette**   (3)

(d)   Precaution = **Stir when addition is made /**
                         have both solutions at same temperature at start /
                         plot temperatures before and after and extrapolate   (6)

(e)   Symbol =   **Spillage burning hand (block) / symbol**   (6)

(f)   (i)   =   **0.1** moles   (3)
       (ii)   =   **57.1** kJ   (6)

         $$\frac{\textbf{5.71}}{\textbf{0.1}} \ (3) \quad = \quad \textbf{57.1} \ \text{kJ} \ (3)$$

       (iii)   =   **– 57.1** kJ mol^{-1} (3)

(g)   Name   =   **Bomb calorimeter**   (6)
                        [Allow 3 marks for 'calorimeter' or 'bomb' on their own]

Question 4

Add one mark to the mark awarded to the first two items for which the highest mark is awarded.

(a)   Name   = **Rutherford**   (6)

(b)   State   = **Cancer treatment / food irradiation**   (6)
                       [Allow 3 marks for 'medicine']

(c)   Trend   = **Decreasing** atomic radii   (6)

(d)   State   = **High melting points // high boiling points // conduct electricity when molten or dissolved in water // usually soluble in water //usually solid at room temp.**
                                                                                                                    (2×3)

(e)   Volume   = **22.4 litres**   (6)

(f)   Acid   = **Ethanoic acid / acetic acid / CH$_3$COOH**   (6)

(g)   Conc.   = **110** cm^3 (6)

$$\boxed{\frac{\mathbf{11}}{\mathbf{100}} \quad (3) \times \mathbf{1000} = \mathbf{110}\ (3)}$$

(h)   Conc.   = **220** p.p.m.   (6)

$$\boxed{\frac{\mathbf{0.022}}{\mathbf{100}} \times \mathbf{1000}\ (3) \times \mathbf{1000} = \mathbf{220}\ (3)}$$

[Allow 3 marks for 0.22 g l^{-1}]

(i) K_c = $\dfrac{\mathbf{[SO_3]^2}}{\mathbf{[SO_2]^2.\ [O_2]}}$ (6)

[Allow 3 marks for top or bottom correct *or* 3 marks for inverted expression]

(j)   Why   = **Kill germs / disinfect**   (6)
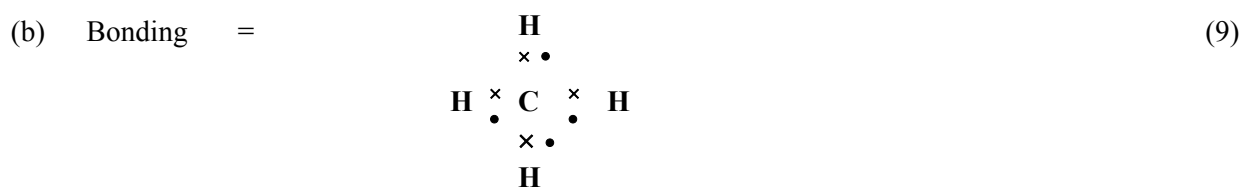   [Allow 3 marks for "making safe to drink"]

(k)   A   = **Infrastructure (or example) / raw materials / tax concessions / access to markets / etc.** (2×3)

       B   = **Steel / brass / bronze**   (3)
                          Mixture / stated contents   (3)

Question 5

(a) 1   = **Pair**   (6)

     2   = **Non-polar**   (6)

     3   = **Polar**   (6)

     4   = **Boiling points**   (6)

     5   = **Water**   (6)

     6   = **Electronegativity**   (6)

(b) Bonding =   H   (9)
                                   × •
                          H × C × H
                             •   •
                                   × •
                                   H
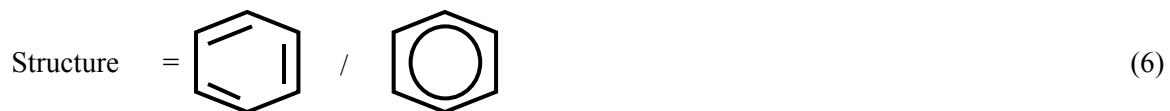
          [Allow 3 marks for carbon with 4 valence electrons 3 marks for hydrogen with one
          valence electron and 3 marks for combining them to give the bonding in the
          molecule]

     Shape   = **Tetrahedral**   (5)

Question 6

(a) (i)   = **Methane**   (5)

  (ii)   = **Ethyne**   (6)

  (iii) = **Hydrogen**   (6)

  (iv)   = **Butane**   (6)

  (v)   = **Benzene**   (6)

(b) Aromatic = **Benzene**   (6)

  Structure =   /   (6)

  [Allow 3 marks for a 6-membered ring]

(c) Disadv. = **Dangerous / expensive to produce / electrolysis needed**   (3)

  State   = **Steam reforming** of methane (natural gas) / **electrolysis** of acidified water   (6)

  [Allow 3 marks for splitting water molecules]

Question 7

(a) Apparatus = **Reaction vessel connected to**

Delivery tube

Collection and measurement of gas $(2 \times 4 + 3)$

[No label – deduct 3 marks]

(b) Graph = **Correctly labelled and scaled axes** (2×3)

[Allow 3 marks only if axes are reversed]

All points plotted correctly   (6)

[Allow 3 marks if 6 to 8 points plotted correctly]

Curve drawn correctly   (6)

[Allow 3 marks if curve does not extend to origin but is otherwise correct]

(c) Rate = Faster after **1 minute**   (3)

Curve is "steeper" / tangent higher slope   (3)

(d) Volume = **13.1 – 13. 7** cm^3 (9)

[If not matched to graph allow 6 marks]

[Full marks available for correct interpretation of the candidate's graph]

(e) Completion = **6.50 – 7.00** minutes   (6)

[If not matched to graph allow 3 marks]

[Full marks available for correct interpretation of the candidate's graph]

Question 8

(a)   Which   = **A / Ethene / C_2H_4 / CH_2CH_2**   (5)

(b)   Which   = **A / Ethene / C_2H_4 / CH_2CH_2**   (6)

(c)   <u>A</u>   = **Ethene**   (6)

       <u>B</u>   = **Ethane**   (6)

       <u>C</u>   = **Chloroethane**   (6)

(d)   (i)   X =   **Addition**   (6)

       (ii)   Y =   **Substitution**   (6)

(e)   Which = **A / Ethene / C_2H_4 / CH_2CH_2**

       Name   = **Polyethene / polythene / polyethylene**   (6 + 3)

Question 9

(a)   What   =   **Presents a difficulty in forming a lather with soaps / produces a scum with soap / contains dissolved calcium (magnesium) salts**   (5)

         Removal   =   **Boiling / ion-exchange / distilling / adding washing soda**   (6)

                       [Allow 3 marks for addition of water softener]

         Name &   =   **Calcium sulfate ($CaSO_4$) / magnesium sulfate ($MgSO_4$) /**

         Formula   **calcium chloride ($CaCl_2$) / magnesium chloride ($MgCl_2$) etc**.   (6 + 3)
                       [Allow 3 marks for a reference to calcium (magnesium) salt]

(b)   (i)   =   **settlement and screening**   (6)

         (ii)   =   **bacterial breakdown**   (6)

         (iii)   =   **phosphates and nitrates**   (6)

         (iv)   =   **eutrophication**   (6)

         (v)   =   **silage effluent / phosphates and nitrates**   (6)

Question 10

(a)　(i)　　　　= **Proton donor / produces H$^+$ ions** in aqueous solution　　　　(4)

　　　(ii)　　　= **Proton acceptor / producer of OH$^-$ ions** in aqueous solution　　(4)

　　　(iii)　　= **Reaction between an acid and a base to give a salt and water**　(5)

　　　　　　　　[Allow 3 marks for the reaction between an acid and a base]

　　　Example　　= **Use of indigestion tablets / neutralisation of bee (wasp or nettle) stings / hair conditioners**　(6)

　　　Name　　　= **Sodium hydroxide / caustic soda / ammonia / potash / magnesium hydroxide / oven cleaners / toothpaste**　(6)

(b)　Definition　= **mass** of atom **relative to** one twelfth of the mass //

　　　　　　　　　of the carbon isotope C-12 (carbon-12)　　　　　　　(4 +3)

　　　Calc.　　　= **98**　　　　　　　　　　　　　　　　　　　　　(6)

　　　　　　　　┌─────────────────────────────────┐
　　　　　　　　│ **2 + 32** (3) **+ (4 × 16)** (3) **= 98** │
　　　　　　　　└─────────────────────────────────┘

　　　Percentage　= **32.65**%　　　　　　　　　　　　　　　　　　　(9)

　　　　　　　　[Allow 32.6 or 32.7]

　　　　　　　　┌──┐
　　　　　　　　│ **32** (3) **× 100** (3) **÷ 98** (3) **= 32.65** │
　　　　　　　　└──┘

　　　Moles　　　= **0.05** moles　　　　　　　　　　　　　　　　　(3)

　　　　　　　　┌──────────────────────────┐
　　　　　　　　│ **4.9 ÷ 98 = 0.05** (3) │
　　　　　　　　└──────────────────────────┘

(c)

	Relative mass	Relative charge	Location
Proton	1	+1	**In the nucleus**
Electron	1/1840	−1	Outside the nucleus
Neutron	**1**	0	In the nucleus

(4 + 3 × 3)

　　　At. No.　　= **Number of protons in the nucleus (in an atom) /**

　　　　　　　　　Charge on the nucleus of an atom　　　　　　　(6)

　　　　　　　　[Allow 3 marks for "number of protons"]

　　　State　　　= **2, 8, 8, 1**　　　　　　　　　　　　　　　　(6)

　　　　　　　　[Allow 3 marks if 2, 8 is given as part of the arrangement]

Question 11

(a) Oxidation = **Electron loss** (7)

    (i) = **Blue solution decolourises / brownish precipitate formed** (6)

        [Allow 3 marks for 'colour change']

    (ii) = **Zinc (Zn)** is oxidised (6)

    (iii) = **Iron** is higher in the electrochemical series (6)

(b) Definition = **Minus the log** to the base 10 **of the hydrogen ion concentration /**

               $- \log_{10} [H^+]$ (7)

    Describe = **Sample in test tube (beaker / container)** (3)

                  Add indicator / dip paper (3)

                  Compare to chart (3)

    Calc. = **3** (9)

> $pH = - \log_{10}$ (3) **[0.001]** (3) **= 3** (3)

(c) **A**

    (i) = **Reactants in industrial process** / prepared **raw materials / materials required** (5)

    (ii) = **Product produced along with the desired product** (5)

    Batch = **Produced in discreet lots / quantity at a time**
    Continuous = **Produced continuously with addition of more raw materials and removal of product / ongoing** (6 + 3)

    Specify = **Pharmaceutical products / health care products / improved lifestyle by producing lighter equipment / medical devices / clothing products etc.** (2 × 3)

    B

    Name = Lawrence and William **Bragg** (5)

    Table =

Type of crystal	*Example*	*Binding Forces*
Ionic	Sodium chloride	**Ionic bonding / electrostatic / attraction between oppositely charged particles (ions)**
Molecular	Iodine	**van der Waals forces / London / dispersion / dipole-dipole**
Covalent macromolecular	Diamond	**Covalent bonds**

                                              (2 × 6 + 3)

    Name = Dorothy **Hodgkin / Crowfoot** (5)